Technology Safety Data Sheet
Remote Underwater Characterization System (RUCS) TMS # 2151

Section 1: Technology Identity

Technology Name(s):	Emergency Contact:
Remote Underwater Characterization System (RUCS) DOE OST TMS # 2151	Inuktun Services Ltd. Toll Free: 1 877 468 5886 info@inuktun.com
Manufacturer's Name and Address:	**Information Contact:**
The RUCS is based on the commercially available "Scallop" vehicle produced by: Inuktun Services, Ltd. British Columbia, Canada www.inuktun.com	Inuktun Services Ltd. 2569 Kenworth Road, Suite C Nanaimo, BC, Canada V9T 3M4 Phone: (250) 729 8080, Fax: (250) 729 8077 Toll Free: 1 877 468 5886
Date Prepared: December 2002	**Date Revised:** Not yet revised.

Section 2: Technology Pictures

Figure 1: Front View of the RUCS.

Figure 2: The RUCS Control Panel on the Right with the Monitor.

Figure 3: The RUCS Control Panel from Above.

Figure 4: The RUCS ROV from the Side.

Section 3: Technology Description

A 125-foot neutral buoyancy tether connects the two sub-systems. The underwater remotely operated vehicle (ROV) measures 12" X 9" X 6" and is rated to a depth of 100 feet. Left and right variable speed horizontal thrusters, both reversible, maneuver the vehicle left and right, and forward and backward. A single, variable speed vertical thruster drives the vehicle to a desired depth, while slightly positive buoyancy will return the vehicle back to the surface. A depth sensor provides depth information back to the operator control station. An on-board compass sends heading information back to the operator control station. The vehicle has a forward looking color camera with tilt capability, a fixed rear- looking black and white camera, and two variable intensity halogen lights for underwater illumination.

The operator control station consists of a single case the size of a standard suitcase. All vehicle controls are operable from the control station. A proportional joystick maneuvers the vehicle on a horizontal plane, and a rotary knob adjusts vertical thruster speed and, thereby, adjusts vehicle depth. Another rotary knob controls light output. An operator may adjust tilt and focus of the forward-looking color camera at the control panel as well. The auto depth feature acts much like a cruise control to allow the operator to hold the vehicle at a selected depth. A relatively simple circular array of light emitting diodes indicates the vehicles heading. A small digital display shows the measured radiation reading (5 mR/hr up to 999 R/hr) from the radiation sensor. A coax video plug allows the operator to display and/or record the video signal from the vehicle cameras and a switch to the console allows switching between the front and rear cameras.

Section 4: Safety Hazards

Hazard Category:

(Adapted from Appendix A to MIL-STD-882D, February 10, 2000, Department of Defense Standard Practice for System Safety.)

4 - Could result in death or permanent total disability

3 - Could result in permanent partial disability or injuries or occupational illness that may result in hospitalization of at least three persons

2 - Could result in injury or occupational illness resulting in one or more lost work days

1 - Could result in injury or illness not resulting in a lost work day

N/A - Is not applicable to this technology and poses no appreciable risk

A. Buried Utilities, Drums, and Tanks	Hazard Rating: N/A

Is not applicable to this technology and poses no appreciable risk.

B. Chemical (Reactive, Corrosive, Pyrophoric, etc)	Hazard Rating: N/A

The pH of the water is neutral in most cases. Identification of site-specific hazards is necessary when using the RUCS in different settings, but within the scope of radiological contaminated pools of water, there is not a chemical hazard.

C.	Confined Space	Hazard Rating:	N/A
Is not applicable to this technology and poses no appreciable risk.			
D.	**Electrical**	**Hazard Rating:**	**2**
The RUCS uses a 120v AC power supply into the control panel. The power supply from the control panel to the ROV is 12v DC. A Ground Fault Circuit Interrupter (GFCI) used on the 120v AC will mitigate electrical hazards.			
E.	**Explosives**	**Hazard Rating:**	**N/A**
Is not applicable to this technology and poses no appreciable risk.			
F.	**Fire Protection**	**Hazard Rating:**	**N/A**
Is not applicable to this technology and poses no appreciable risk.			
G.	**Gas Cylinders**	**Hazard Rating:**	**N/A**
Is not applicable to this technology and poses no appreciable risk.			
H.	**Ladders/Platforms**	**Hazard Rating:**	**N/A**
Is not applicable to this technology and poses no appreciable risk.			
I.	**Lockout/Tagout**	**Hazard Rating:**	**2**
• Locking out and tagging out the control panel is necessary during repairs to the ROV, while the risk is minimal with 12v DC, electrical hazards are present. • Locking out and tagging out the control panel during mechanical maintenance and repairs to the ROV is necessary in order to protect users from contact with small moving parts such as the propellers. • Plug and cord pieces of equipment do not require lockout/tagout but using a GFCI and a cord plug-locking device would be considered safe work practices.			
J.	**Mechanical Hazards**	**Hazard Rating:**	**1**
The ROV does have small moving mechanical parts including the small propellers. The propellers are guarded and would only be an issue during maintenance.			
K.	**Moving Vehicles**	**Hazard Rating:**	**N/A**
Is not applicable to this technology and poses no appreciable risk.			
L.	**Overhead Hazards**	**Hazard Rating:**	**N/A**
Is not applicable to this technology and poses no appreciable risk.			

M. Pressure Hazards	Hazard Rating: N/A
Is not applicable to this technology and poses no appreciable risk.	

N. Slips/Trips/Falls	Hazard Rating: 1
• A tether connects the ROV and control panel. Tether management may be required and care must be used when working around the tether to avoid tripping. • The ROV will be used in pools of water. During removal of the ROV, users may be working on a slick surface because of water dripping off the ROV and tether.	

O. Suspended Loads	Hazard Rating: N/A
Is not applicable to this technology and poses no appreciable risk.	

P. Trenching/Excavation	Hazard Rating: N/A
Is not applicable to this technology and poses no appreciable risk.	

Section 5: Health Hazards

A. Inhalation	Hazard Rating: N/A
Site-specific hazards should be identified. Within the scope of the present application, most pools will have a pH around 7 with little or no inhalation hazards.	

B. Skin Absorption	Hazard Rating: 1
During retrieval in a contaminated environment, depending on the chemical form of the contamination, it may be possible for some skin contamination. This will vary from site to site and pool to pool. Identification of site-specific hazards before each use will mitigate skin absorption hazards.	

C. Noise	Hazard Rating: N/A
The RUCS is not a source of noise. Site-specific sources of noise may be present.	

D. Heat Stress/Cold Stress	Hazard Rating: N/A
The RUCS does not create heat stress or cold stress hazards. If the environment requires an individual to manage the tether around obstacles inside a hot area, a heat stress hazard will be present and compounded by the use of PPE.	

E. Ergonomics	Hazard Rating: 1
Ergonomically the RUCS poses no serious hazards. If a user is managing the tether around a number of obstacles, they may exert some effort but the ROV and tether are both light weight and would not involve repetitive actions.	

F. Ionizing Radiation	Hazard Rating: 2

- There is a potential for contamination of the tether, external contamination of the ROV, and internal contamination of the motor components of the ROV. The level of contamination will depend on the amount of ionizing radiation present from site to site and pool to pool.
- Effects of the ionizing radiation will not be acute but chronic showing up over time.

G. Non-ionizing Radiation	Hazard Rating: N/A

Is not applicable to this technology and poses no appreciable risk.

H. Biological Hazards	Hazard Rating: N/A

Within the present scope, there will not be biological hazards but identification of site-specific hazards will always be necessary before operation.

Section 6: Phase Analysis

A. Construction/Start-up

- Introduction of the ROV into the pool may result in contamination from splash, contact, or inhalation.
- Distributing the tether will require minimal physical effort but may increase when placing the tether around obstacles.
- Introducing the tether near the pool may result in contamination from splash or contact.
- Energizing the control panel on a GFCI circuit will mitigate hazards associated with shock or electrocution.
- Identification of site-specific hazards will always be necessary before operation. The surface of pools may have contamination present that could be disturbed during introduction of the ROV.

B. Operation

During operation, one person may be required to manage the tether depending on obstacles and the environment. Remote operation allows the operator to control the RUCS outside the contaminated area.

C. Maintenance (Emergency and Routine)

- Applying existing lockout/tagout procedures during maintenance will protect users from contact with electricity and small moving mechanical parts.
- During maintenance, there is a possibility of exposure to contaminated components including the tether, the external shell of the ROV, and the internal mechanical parts of the ROV.

D. Shutdown (Emergency and Routine)

Shutdown steps, both emergency and routine, include turning off the control panel, unplugging the control panel from the power source, and locking out and tagging out the system if necessary.

E. Decontamination/Decommissioning

- Decontamination of the RUCS includes cleaning both the tether and external surfaces of the ROV and replacing internal contaminated components. After cleaning and replacement, the system must have a radiological survey performed before releasing it for use outside the contaminated area.
- Without decontaminating the entire system, bagging the ROV and the tether will provide contamination control. The highest point of contamination is marked on the tether and subsequently bagged to that point, protecting users from exposure.

Section 7: Worker Protection Measures

A. Exposure Monitoring

- Identification of site-specific hazards is necessary to determine the level and type of exposure monitoring. Within the present scope of operation, inside radiation contaminated environments, operators should wear personal radiation dosimeters.
- After decontamination, radiation surveys on all components are necessary before releasing the RUCS for use outside the contaminated area.

B. Worker Training

- Radiation Worker I Training (RWI)
- Radiation Worker II Training (RWII)
- General Employee Radiological Training (GERT)
- Radiation Orientation Training
- Technology specific training
- Lockout/tagout with emphasis on electrical awareness

C. Medical Surveillance

Site-specific requirements will apply, including radiation exposure monitoring.

D. Engineering Controls

- The RUCS is an engineering control designed to eliminate or limit the number of users in a contaminated area.
- The use of a GFCI is suggested but not required.

E. Administrative Controls

- Radiological Work Permit is required while working within the present scope.
- Administrative controls protecting workers while working in a contaminated area will already be in place.
- The RUCS does not require administrative controls.

F. Personal Protective Equipment

- Establishing the contamination level will determine the level of protection needed.
- Standard PPE while working in a radiation-contaminated area includes gloves and a radiation suit. Identification of site-specific hazards and the level of contamination are paramount in determining the level and type of PPE needed.

Section 8: Emergency Preparedness

The RUCS does not require additional emergency preparedness other than what would already be in place for working in a radiation-contaminated area.

Section 9: Comments, Lessons Learned, & Special Considerations

The level of radiological contamination and the existence or type of air contaminants will vary from site to site and even pool to pool within the same site. Characterization and identification of the hazards inside the work area before introducing the ROV and the tether to the pool is crucial to protecting the worker.

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Copies of this Technology Safety Data Sheet and others developed by the Operating Engineers National Hazmat Program can be found on the internet at: www.iuoeiettc.org.